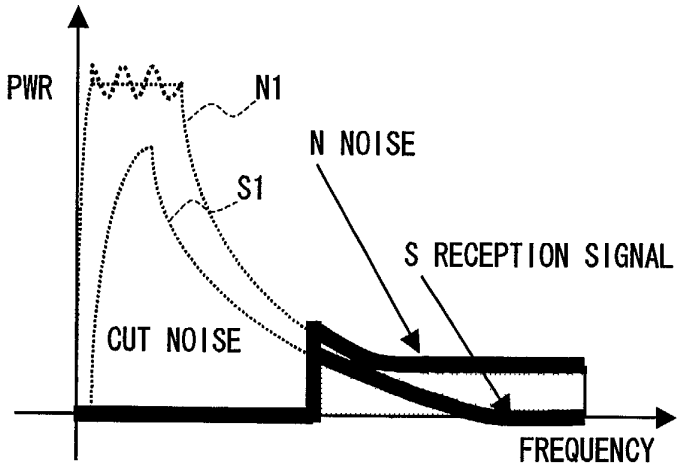


FIG. 1A
PRIOR ART

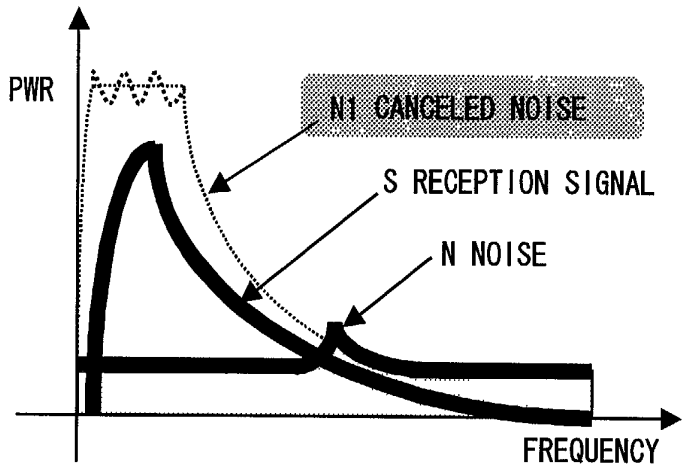


FIG. 1B
PRESENT INVENTION

FIG. 2A PRIOR ART

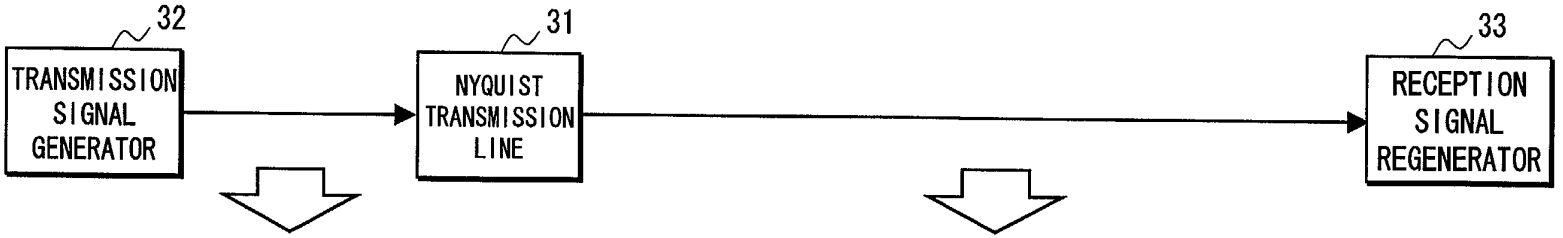


FIG. 2B PRESENT INVENTION

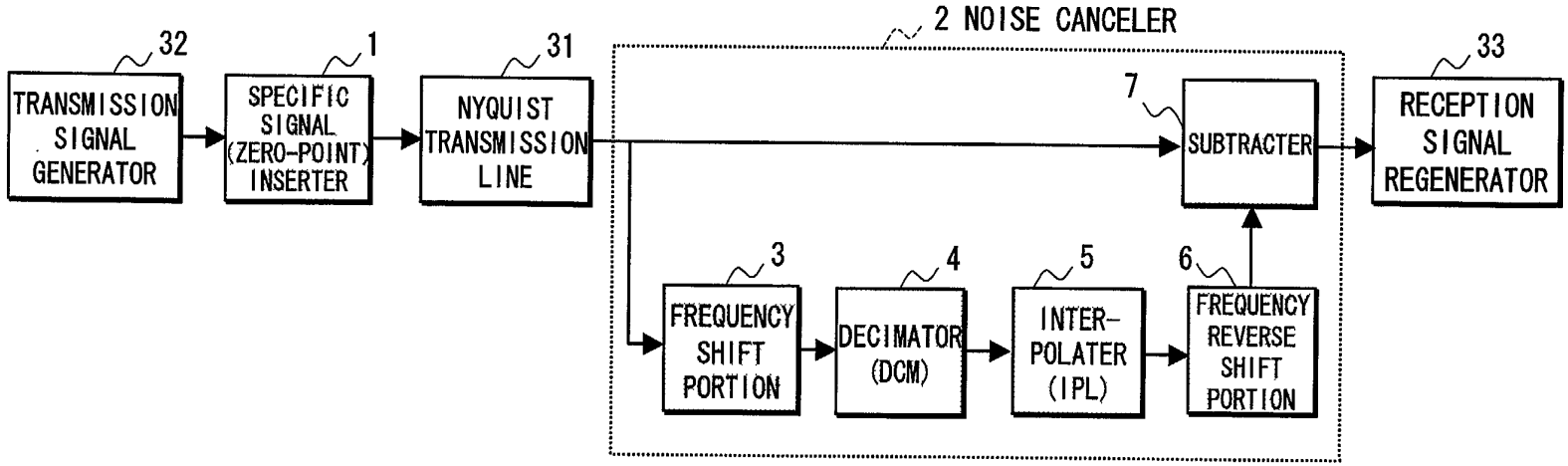


FIG. 3A

192kB TRANSMISSION

FIG. 3B

TRANSMISSION AFTER ZERO-POINT INSERTION

FIG. 3C

RECEPTION SIGNAL

FIG. 3D

NOISE INTERPOLATION SIGNAL

FIG. 3E

AFTER NOISE CANCELATION

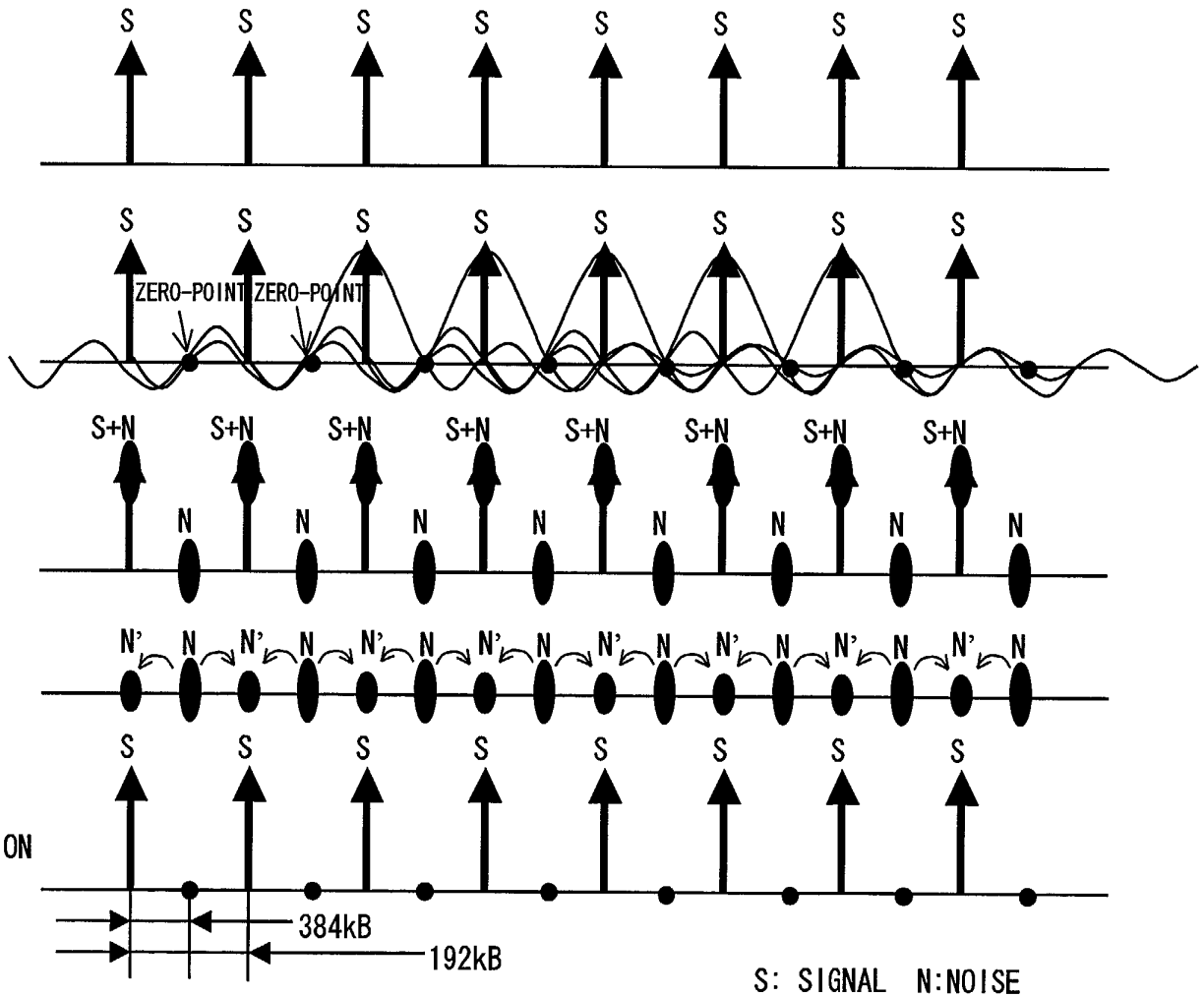


FIG. 4A SIGNAL POINT ON TRANSMISSION SIDE
(UPON 192kB TRANSMISSION AFTER GENERATING TRANSMISSION SIGNAL POINT)

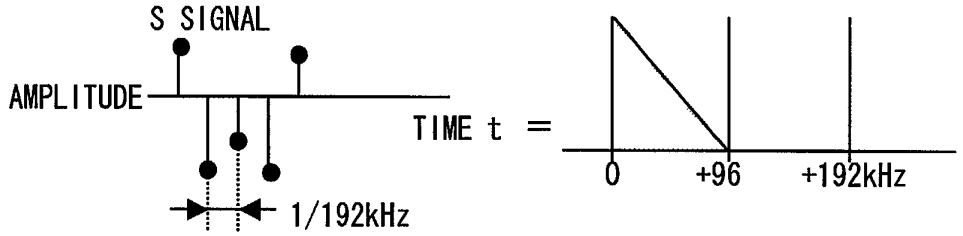


FIG. 4B SIGNAL POINT ON TRANSMISSION SIDE (384kB AFTER ZERO-POINT INSERTION)

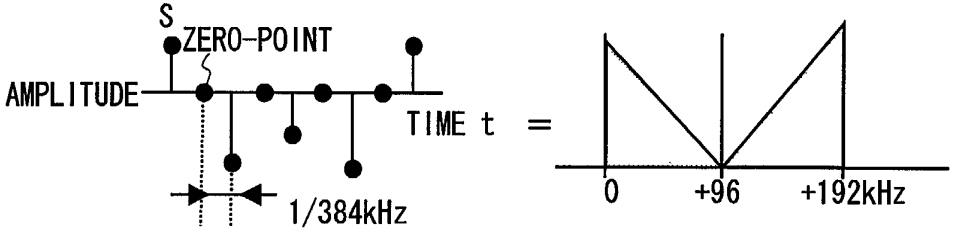


FIG. 4C SIGNAL POINT ON RECEPTION SIDE (384kB AFTER NYQUIST TRANSMISSION LINE)

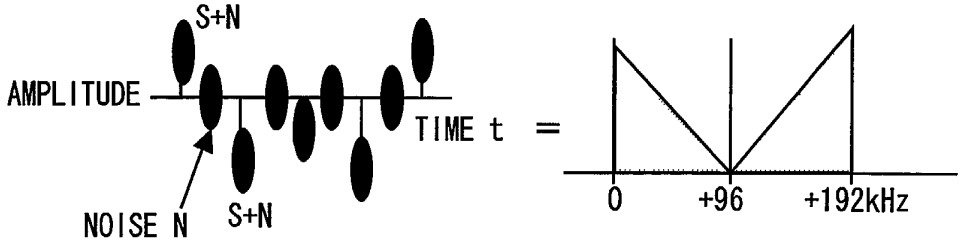


FIG. 5A SAMPLE VALUE & SPECTRUM OF SIGNAL S(n)

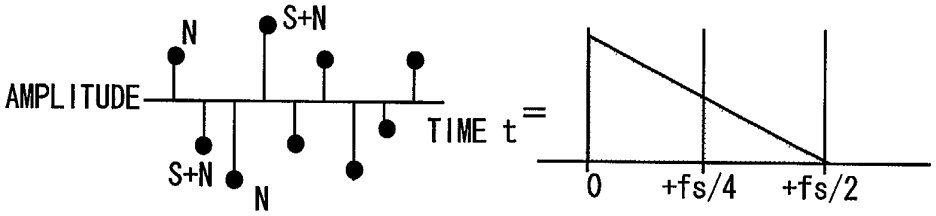


FIG. 5B SAMPLE VALUE & SPECTRUM OF SIGNAL $(-1)^n*S(n)$

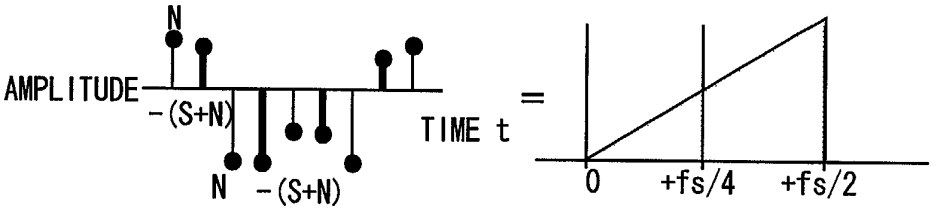


FIG. 5C SAMPLE VALUE & SPECTRUM OF SIGNAL t(n)

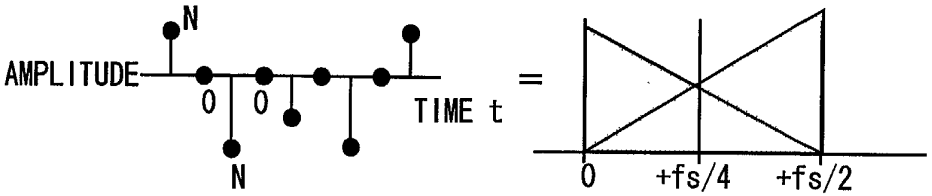


FIG. 5D SAMPLE VALUE & SPECTRUM OF SIGNAL u(n)

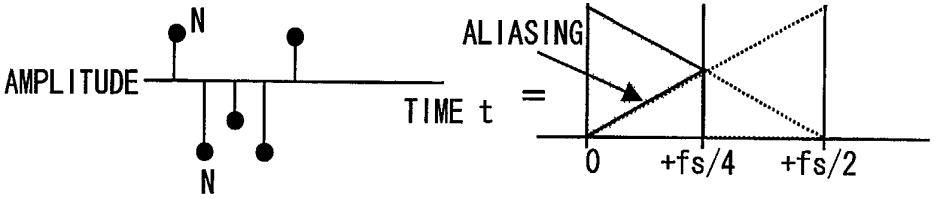


FIG. 6A SAMPLE VALUE & SPECTRUM OF SIGNAL u(n)

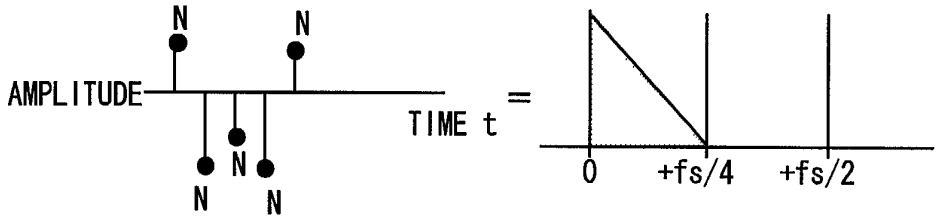


FIG. 6B SAMPLE VALUE & SPECTRUM OF SIGNAL t(n)

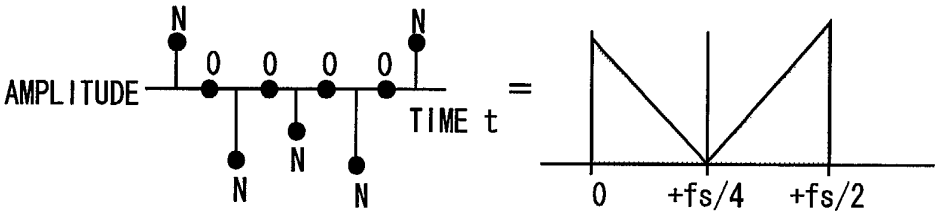


FIG. 7

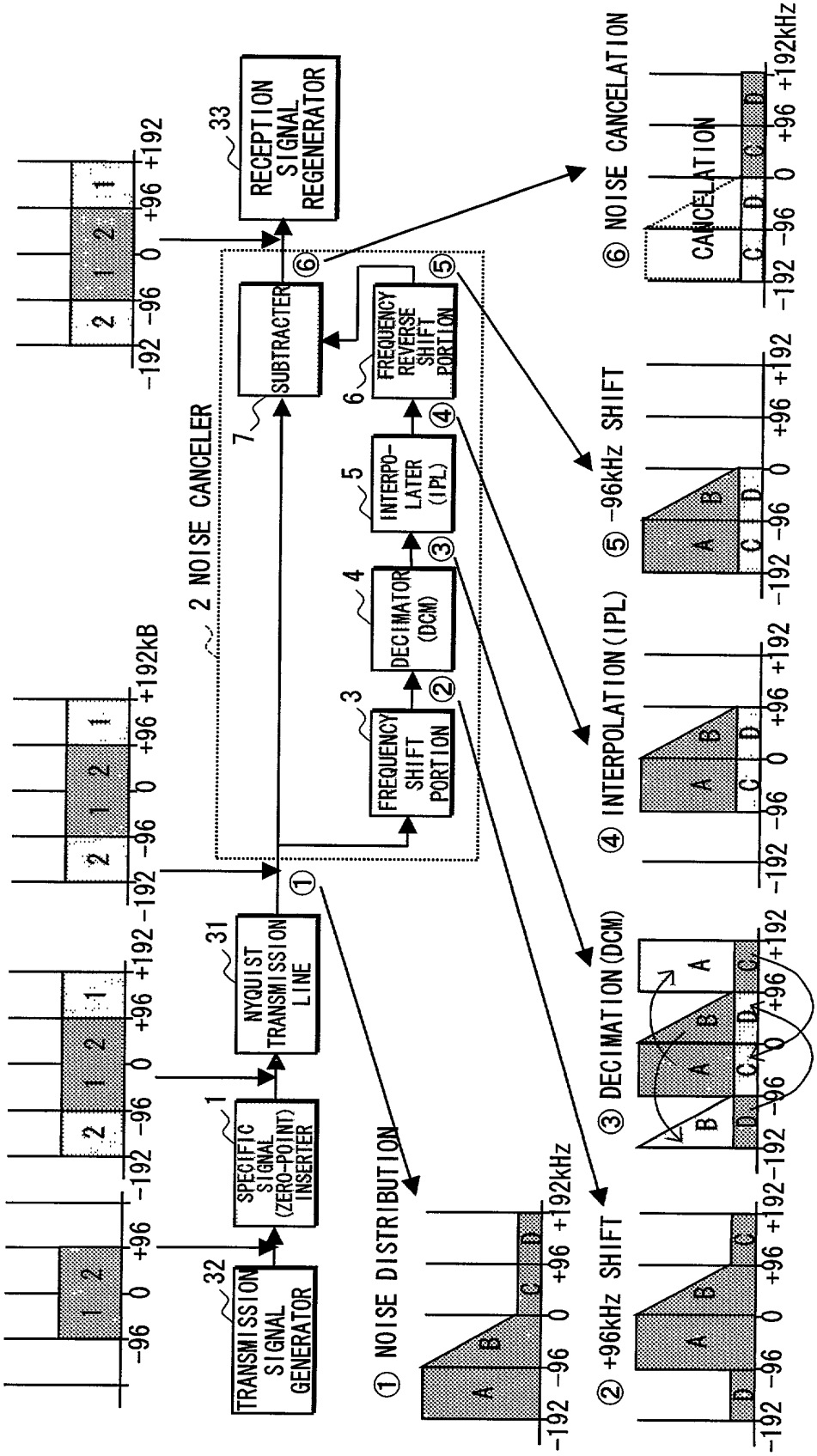

TRANSMISSION SIGNAL GENERATOR
SPECIFIC SIGNAL (ZERO-POINT) INSERTER
NYQUIST TRANSMISSION LINE
2 NOISE CANCELER
FREQUENCY SHIFT PORTION
DECIMATOR (DCM)
INTERPO-LATER (IPL)
FREQUENCY REVERSE SHIFT PORTION
SUBTRACTER
RECEPTION SIGNAL REGENERATOR
① NOISE DISTRIBUTION
② +96kHz SHIFT
③ DECIMATION (DCM)
④ INTERPOLATION (IPL)
⑤ -96kHz SHIFT
⑥ NOISE CANCELATION
CANCELATION
-192kB
+192kB
-192kHz
+192kHz

FIG. 8A

ZERO-POINT: INSERTED INTO EVERY 4TH SIGNAL POINT
INTERPOLATED NOISE BANDWIDTH: 96kHz

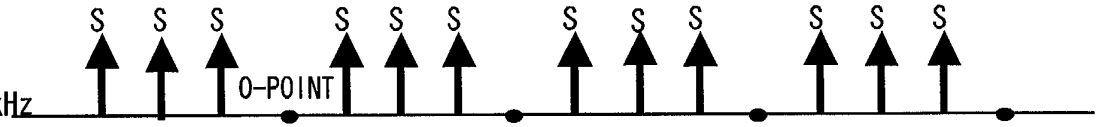


FIG. 8B

ZERO-POINT: INSERTED INTO EVERY 3RD SIGNAL POINT
INTERPOLATED NOISE BANDWIDTH: 128kHz

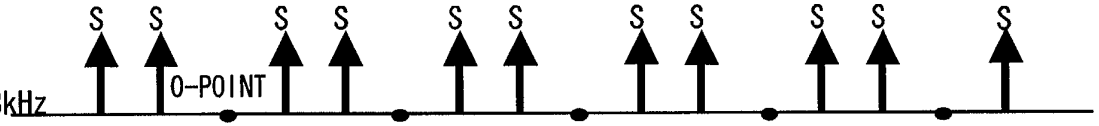


FIG. 8C

ZERO-POINT: INSERTED INTO EVERY OTHER SIGNAL POINT
INTERPOLATED NOISE BANDWIDTH: 192kHz

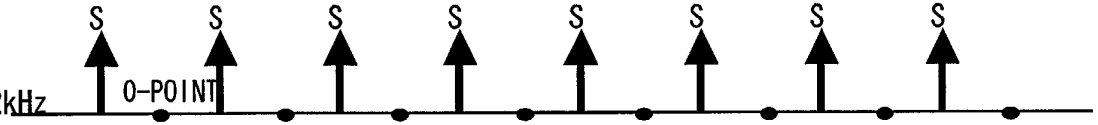


FIG. 8D

ZERO-POINT: 2 ZERO-POINTS INSERTED BETWEEN SIGNAL POINTS
INTERPOLATED NOISE BANDWIDTH: 256kHz

FIG. 8E

ZERO-POINT: 3 ZERO-POINTS INSERTED BETWEEN SIGNAL POINTS
INTERPOLATED NOISE BANDWIDTH: 288kHz

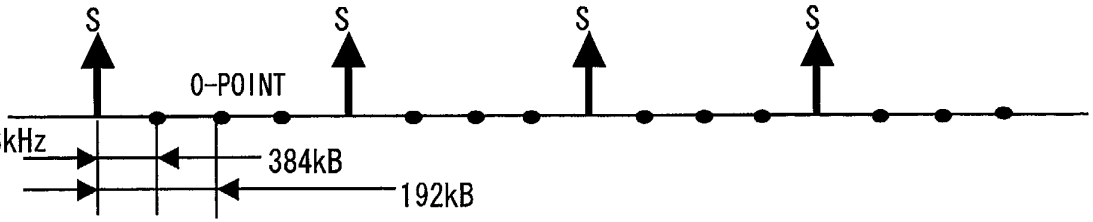
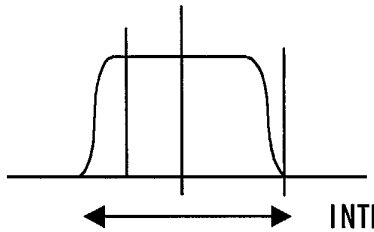


FIG. 9A LOW-PASS FILTER

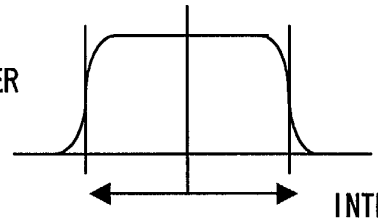


▲ NUMBER OF TAPS IS LARGE & CANCELATION RANGE IS SMALL

○ NO ALIASING OUTSIDE INTERPOLATION BANDWIDTH

INTERPOLATION BANDWIDTH

FIG. 9B COS-SQUARED FILTER

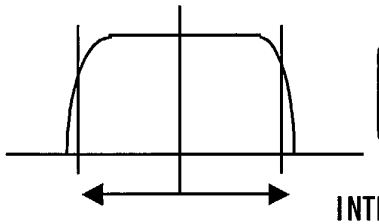


○ NUMBER OF TAPS IS SMALL & CANCELATION RANGE IS LARGE

▲ ALIASING EXSITS OUTSIDE INTERPOLATION BANDWIDTH

INTERPOLATION BANDWIDTH

FIG. 9C COS FILTER



▲ NUMBER OF TAPS IS LARGE & CALCULATION AMOUNT IS LARGE

▲ ALIASING EXSITS OUTSIDE INTERPOLATION BANDWIDTH

INTERPOLATION BANDWIDTH

FIG. 10A

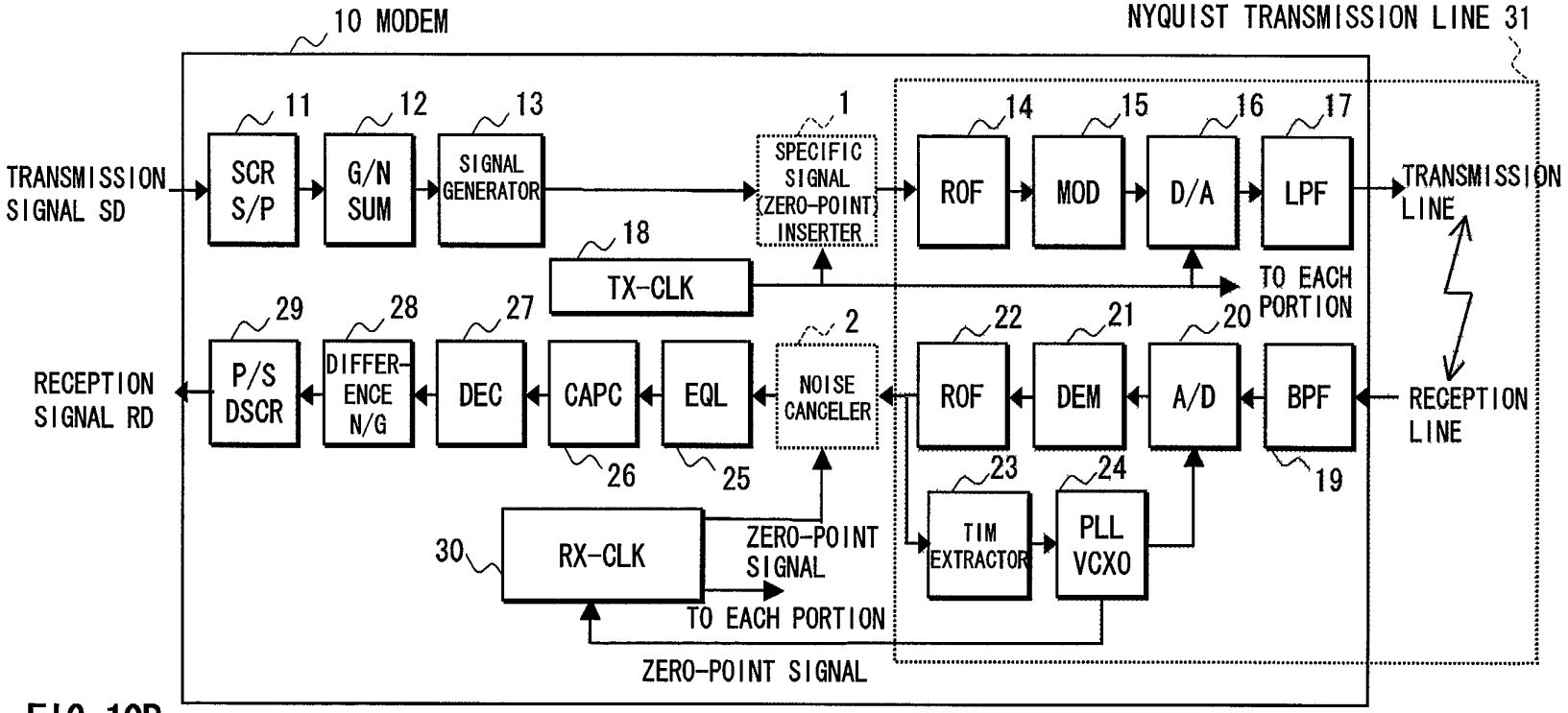


FIG. 10B

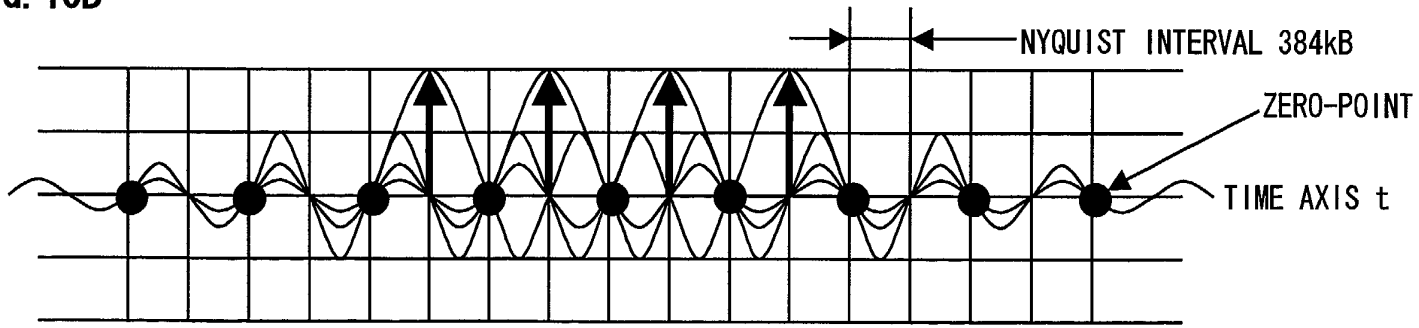


FIG. 11

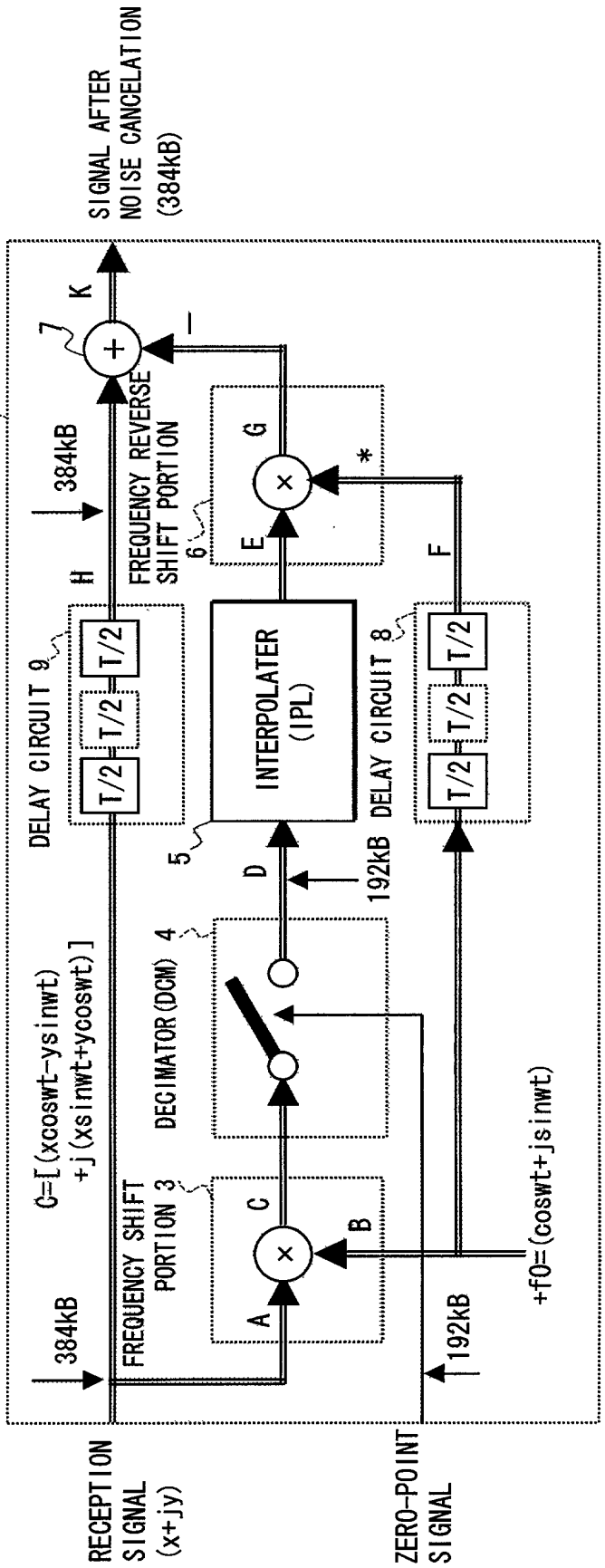

2
SIGNAL AFTER NOISE CANCELATION (384kB)
7
K
+
−
384kB
H
DELAY CIRCUIT 9
T/2
T/2
T/2
FREQUENCY REVERSE SHIFT PORTION
6
G
E
*
INTERPOLATER (IPL)
5
D
192kB
DELAY CIRCUIT 8
F
T/2
T/2
T/2
C
B
A
DECIMATOR(DCM) 4
FREQUENCY SHIFT PORTION 3
384kB
G=[(xcoswt−ysinwt) +j(xsinwt+ycoswt)]
192kB
+f0=(coswt+jsinwt)
RECEPTION SIGNAL (x+jy)
ZERO-POINT SIGNAL

FIG. 12

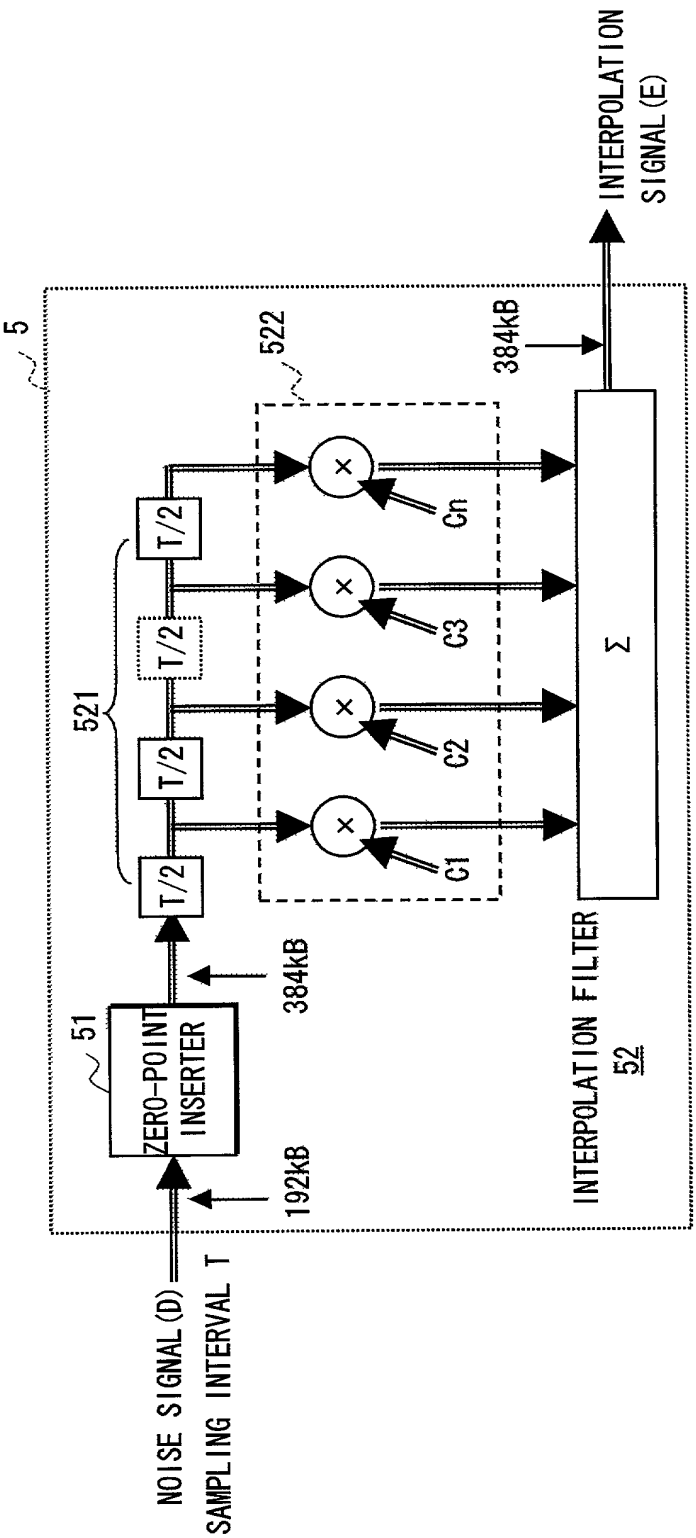

5
NOISE SIGNAL (D)
SAMPLING INTERVAL T
192kB
51
ZERO-POINT INSERTER
384kB
521
T/2
T/2
T/2
T/2
522
C1
C2
C3
Cn
384kB
Σ
INTERPOLATION FILTER
52
INTERPOLATION SIGNAL (E)

FIG. 13

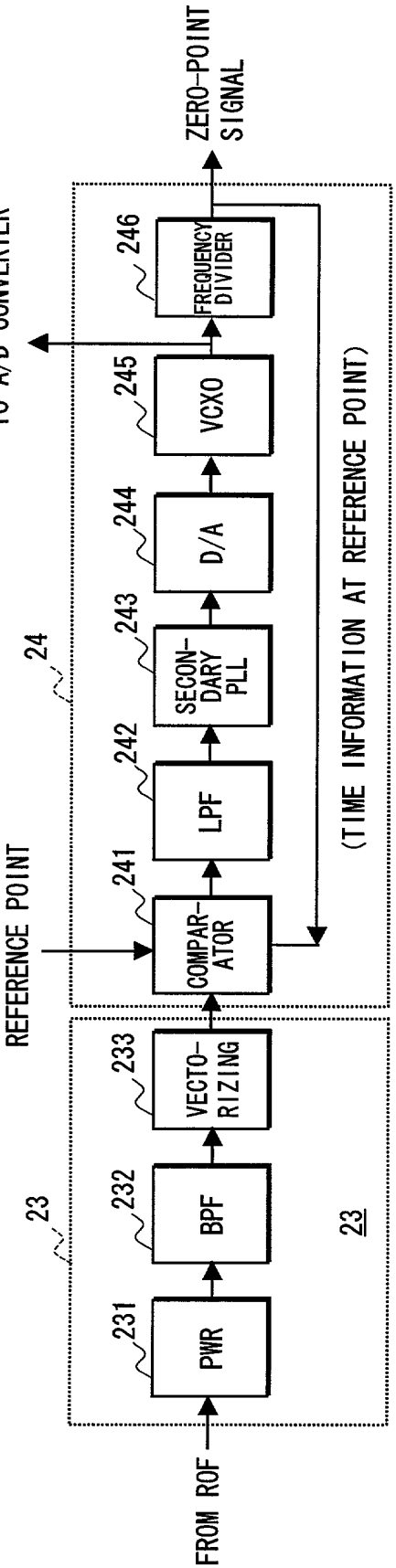
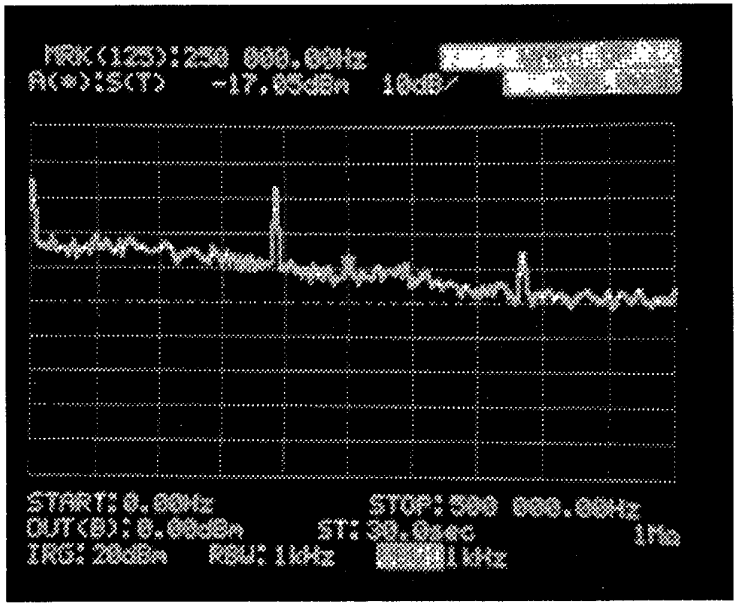

FROM ROF
23
231
PWR
232
BPF
233
VECTO-RIZING
REFERENCE POINT
24
241
COMPAR-ATOR
242
LPF
243
SECON-DARY PLL
244
D/A
245
VCXO
246
FREQUENCY DIVIDER
TO A/D CONVERTER
ZERO-POINT SIGNAL
(TIME INFORMATION AT REFERENCE POINT)
23

FIG. 14



(LINE SPECTRUM IN THE CENTER OF THE PHOTO IS ZERO-POINT SIGNAL OF 192kHz)

JP08265850A

FIG. 15

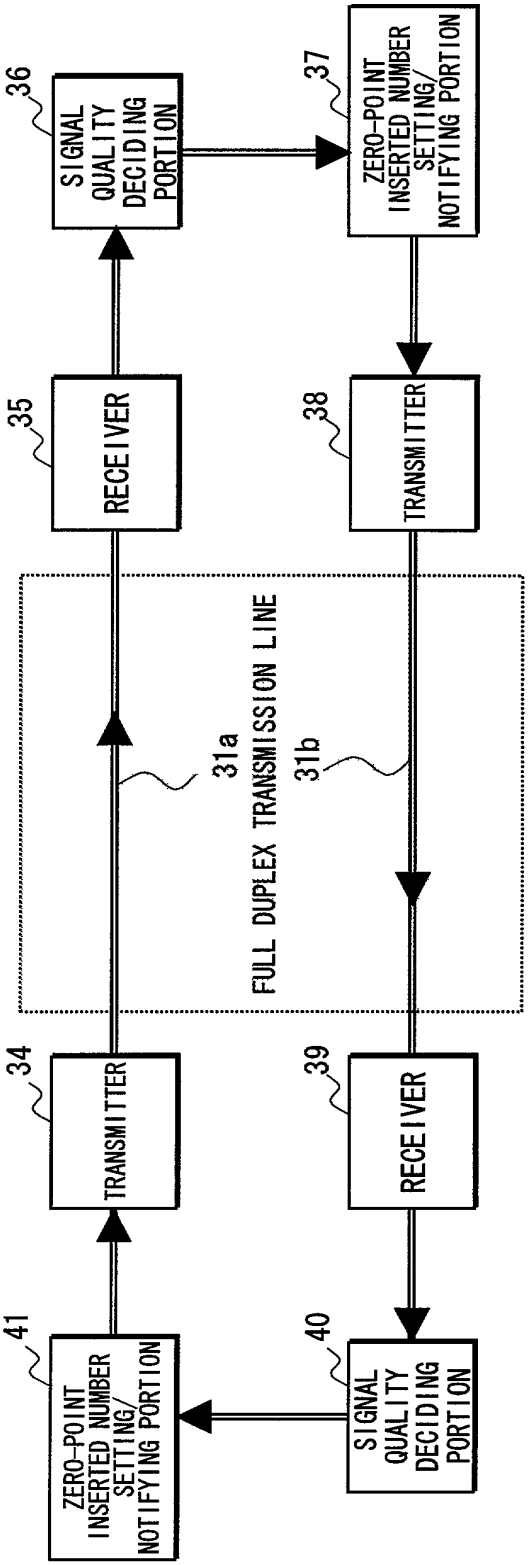


FIG. 16

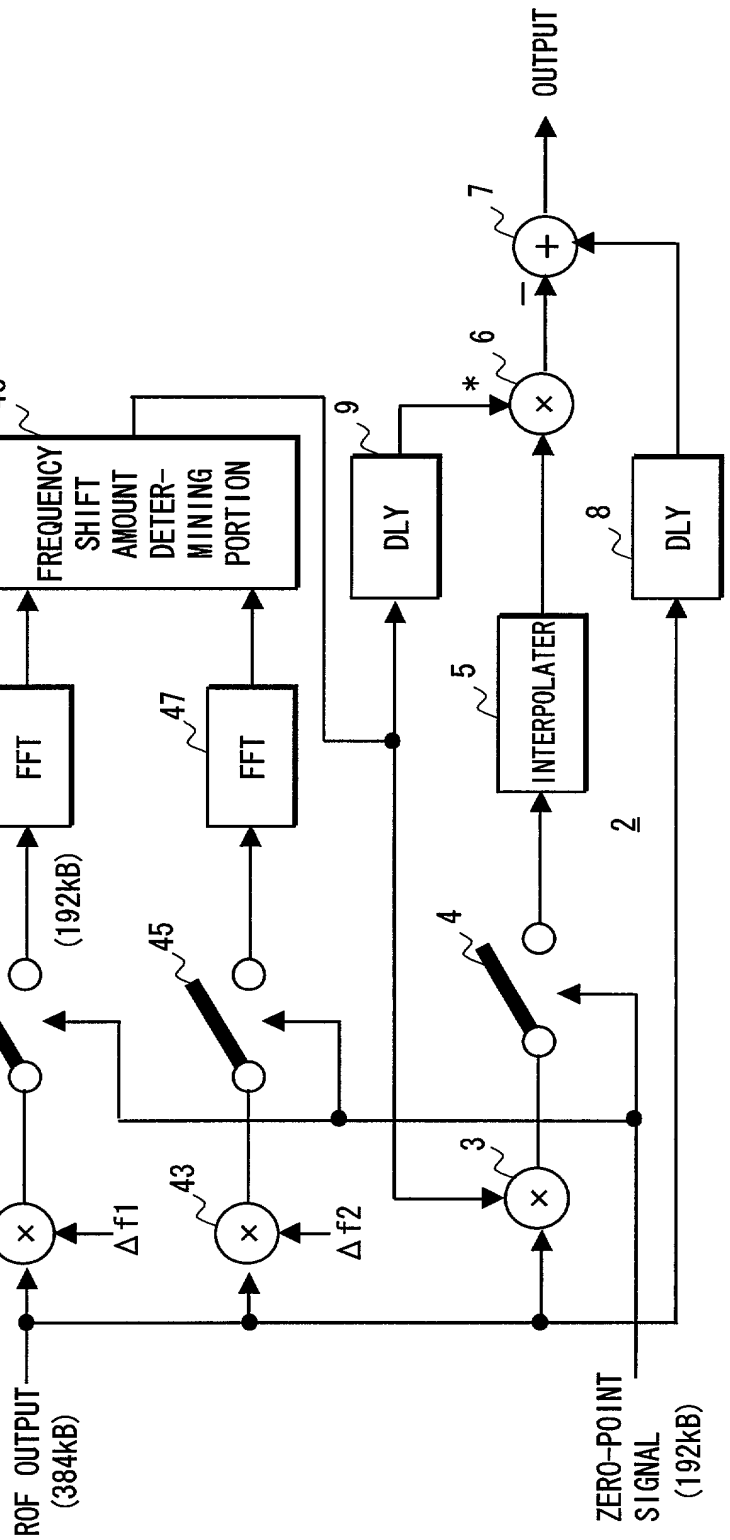

ROF OUTPUT (384kB)
ZERO-POINT SIGNAL (192kB)
OUTPUT
FREQUENCY SHIFT AMOUNT DETER-MINING PORTION
FFT
FFT
INTERPOLATER
DLY
DLY
Δf1
Δf2
(192kB)
42
43
44
45
46
47
48
3
4
5
6
7
8
9
2

FIG. 17

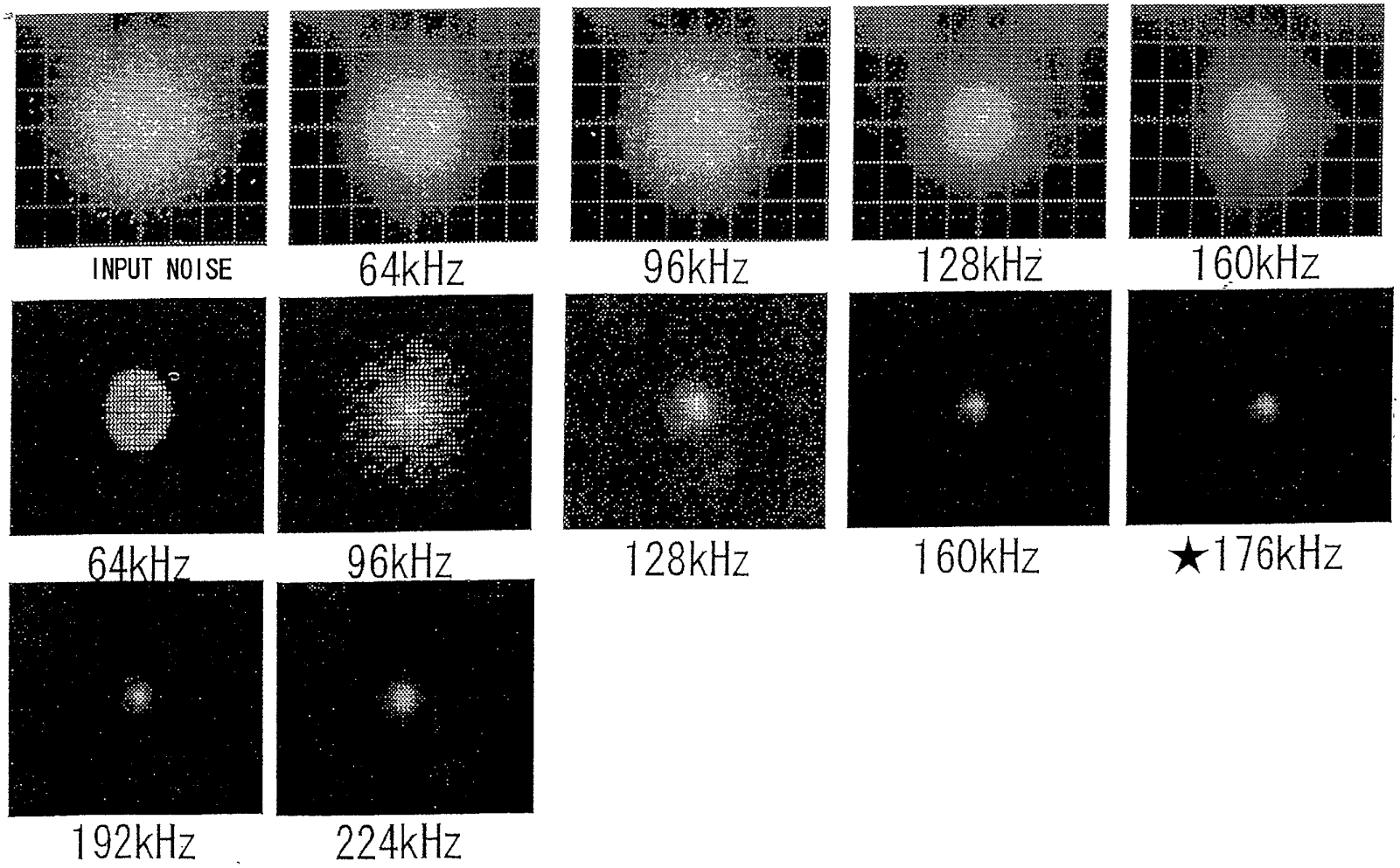

INPUT NOISE
64kHz
96kHz
128kHz
160kHz
64kHz
96kHz
128kHz
160kHz
★176kHz
192kHz
224kHz

FIG. 18A

TRANSMISSION BANDWIDTH
(LINE SIGNAL)

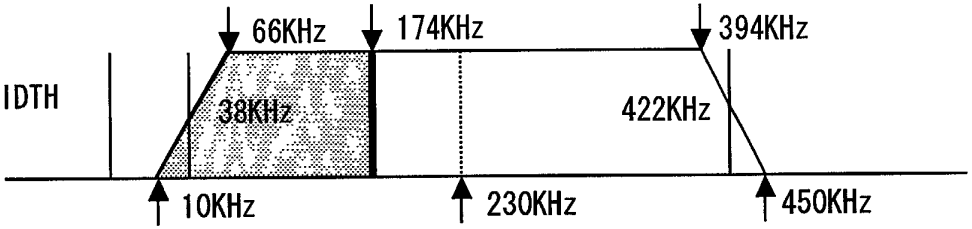


FIG. 18B

BASEBAND
(ROF OUTPUT)

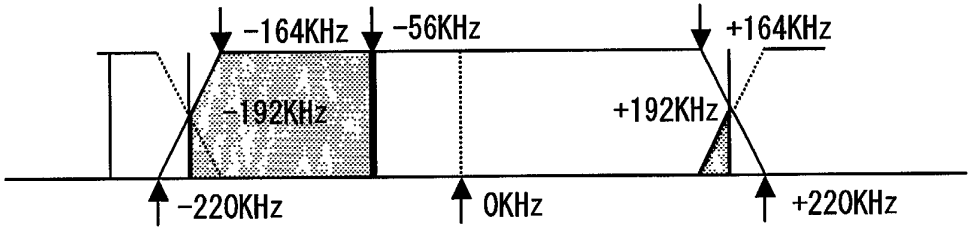


FIG. 18C

AFTER FREQUENCY SHIFT
(AFTER +138kHz SHIFT)

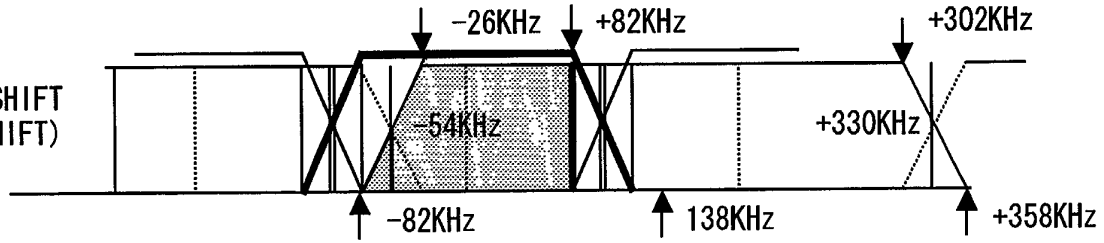
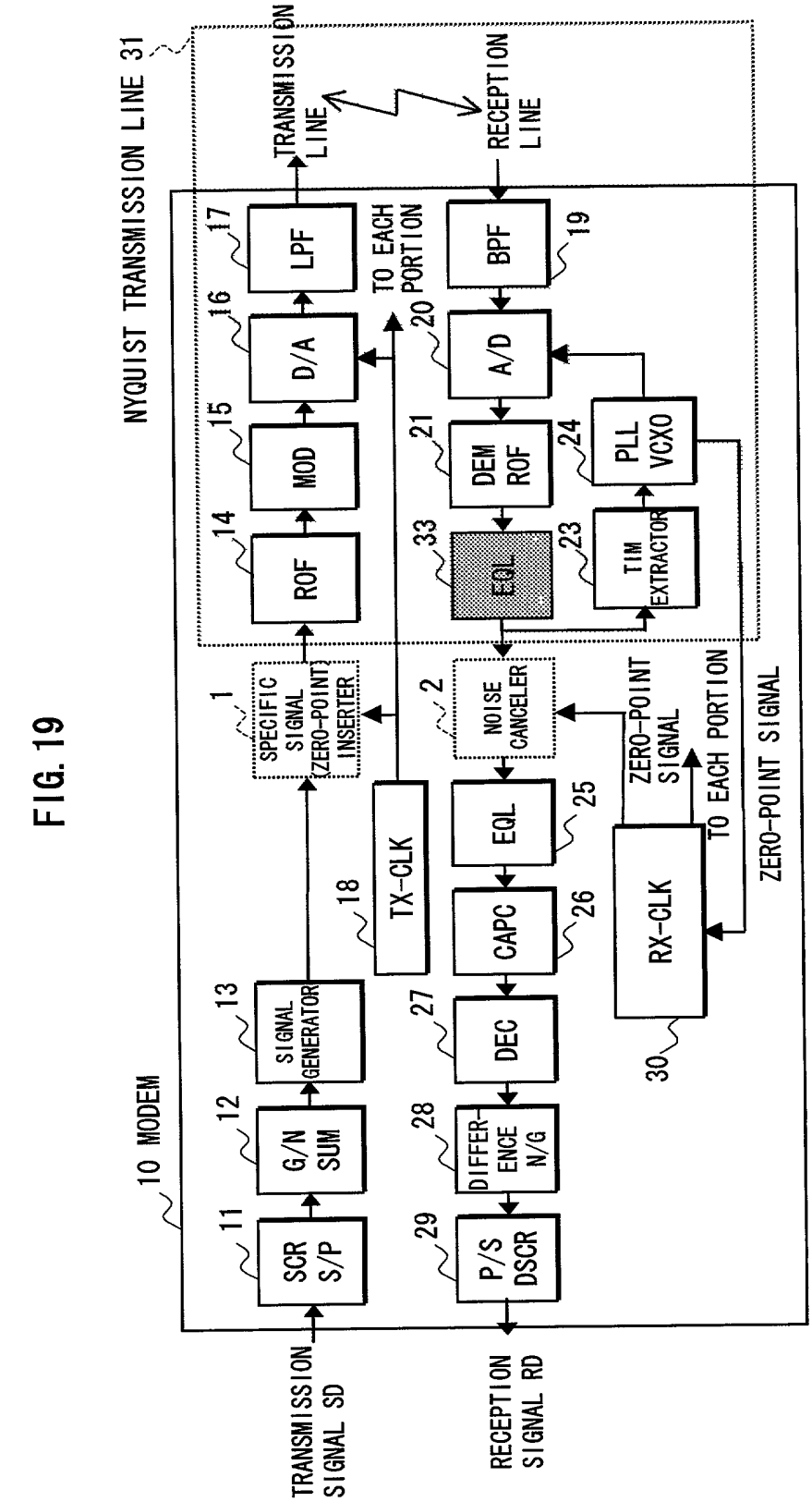
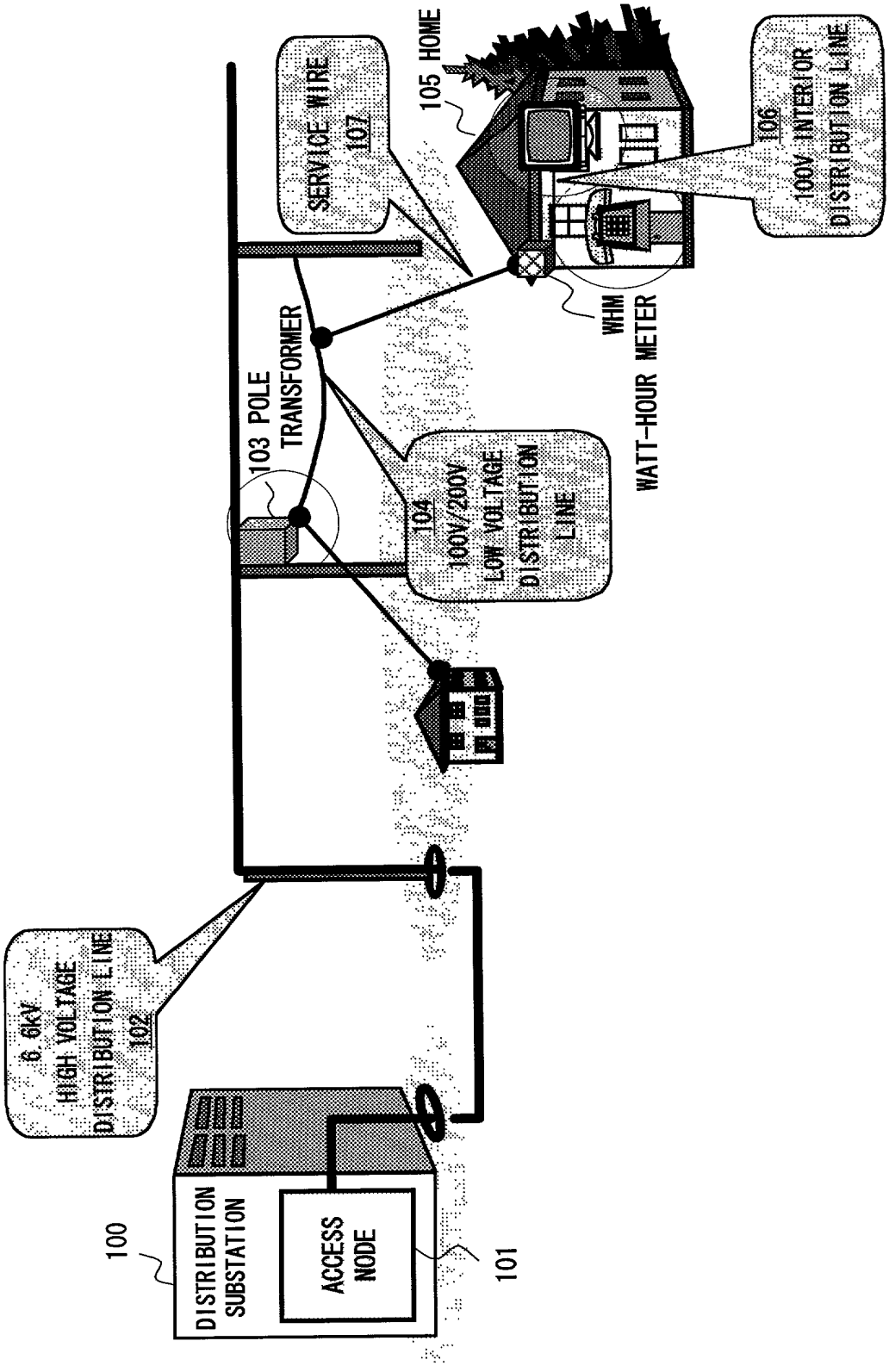


FIG. 19


NYQUIST TRANSMISSION LINE 31
10 MODEM
TRANSMISSION LINE
RECEPTION LINE
TO EACH PORTION
ZERO-POINT SIGNAL
TRANSMISSION SIGNAL SD
RECEPTION SIGNAL RD
SCR S/P
G/N SUM
SIGNAL GENERATOR
SPECIFIC SIGNAL (ZERO-POINT) INSERTER
ROF
MOD
D/A
LPF
TX-CLK
DIFFER-ENCE N/G
DEC
CAPC
EQL
NOISE CANCELER
P/S DSCR
RX-CLK
ZERO-POINT SIGNAL
TO EACH PORTION
BPF
A/D
DEM ROF
EQL
TIM EXTRACTOR
PLL VCXO
1
2
11
12
13
14
15
16
17
18
19
20
21
23
24
25
26
27
28
29
30
33

EP 0 856 970 A2

FIG. 20



PRIOR ART

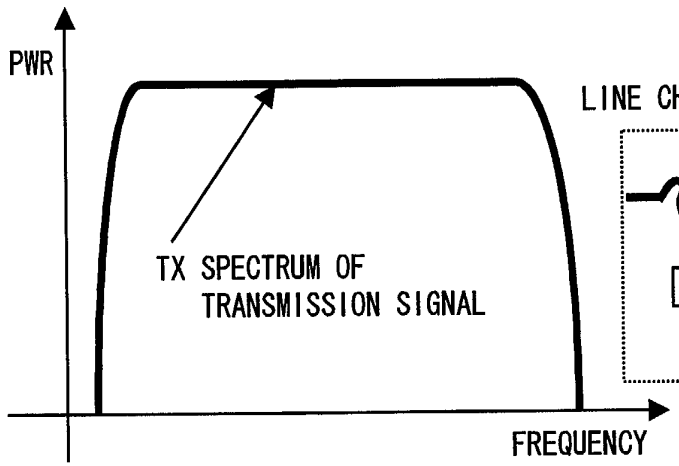


FIG. 21A

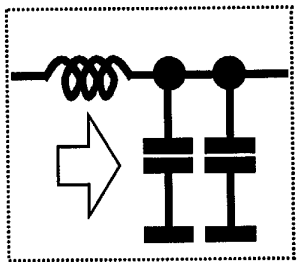


FIG. 21B

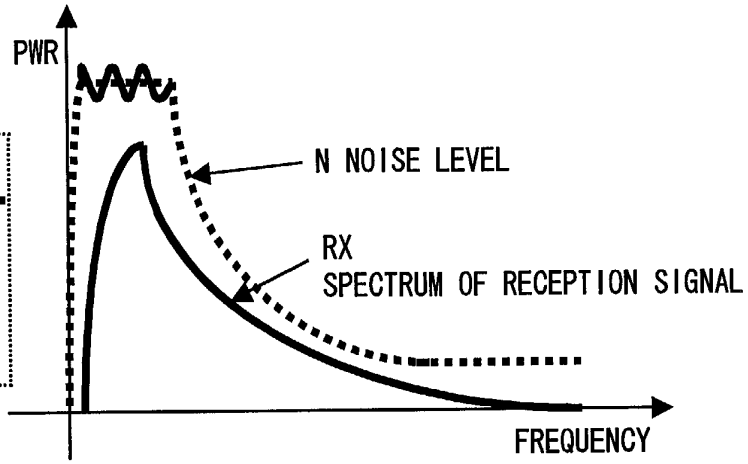


FIG. 21C